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Posted Date: 14 November 2023

doi: 10.20944/preprints202311.0904.v1

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The Relationship between Body Mass Index and Duration of Total Knee Replacement Surgery: A Prospective Cross Sectional Study

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Abstract: Introduction: These days, obesity is considered an important factor for many medical problems such as diabetes mellitus, cardiovascular diseases and joint degeneration. Obesity is one of the leading causes of osteoarthritis and the need for arthroplasty. We aim to study the effect of obesity and the duration of knee replacement surgery. Method: A cross-sectional study was conducted at the orthopedic department between February 2023 and July 2023. We had 68 patients who underwent total knee replacement surgery. Variables like age, gender, smoking history, ASA grade, BMI, and side of injury (unilateral or bilateral) were studied. Results: Out of 68 patients, we had 37 (54.4 %) of patients were female. The most common age group was 44- 54 years. 60.3 % of patients were non-smokers. We had 50 patients with unilateral injury and the rest were bilateral. ASA grade II (51 patients) were more than ASA grade I (17 patients). In this study, 41 patients were obese and the duration for total knee replacement was 90 - 120 minutes, in contrast to overweight patients (75 – 90 minutes) and normal patients (60-75 minutes). Conclusion: We found a significant correlation between BMI and the duration of total knee replacement surgery. The time could be doubled if the arthroplasty was bilateral.

Keywords: obesity; total knee replacement surgery; BMI

Introduction

In past and present, obesity is considered an important and modifiable risk factor for poor health. There is a rise in its prevalence in most of the world especially the United States. In the literature, it is well known and established the strong correlation between the development of knee osteoarthritis and obesity. In addition, patients with obesity well develop a symptomatic osteoarthritis greater than normal patients. (1)

With the advancement in orthopedics medicine, most patients with obesity and developed osteoarthritis, they will have better quality of life if they underwent knee arthroplasty. This cost-effective technique showed that it was a successful treatment for these patients (2).

We can calculate the body mass index (BMI) in kg/ height in meters squared.

BMI has (6 categories) according to WHO. They are: underweight, normal, pre obesity/overweight, obesity class 1, obesity class 2 and obesity class 3.

Patients with BMI more than 30 kg/m^2 have shown a remarkable response to joint replacement surgery including the quality of line and the pain (3).

 doi:10.20944/preprints202311.0904.v1

In recent years, studies have shown an increase in the duration of joint replacement and the need for more anesthesia in patients with elevated BMI before surgery. These also can lead to increase costs, analgesic durg administration, and infection. However, new and wide studies still not conclude this consequence of increased BMI. (4).

For this purpose, we aimed to study the comparison between obese and non-obese patient on duration of total knee replacement surgery.

Methods

We conducted a cross-sectional study during February 2023–July 2023.

Our main goal was to know if BMI has an effect on the duration of total knee replacement surgery (TKR). During this time, we had 68 patients who underwent TKR surgery.

All patients were assessed by the same orthopedic surgeon before the decision of surgery. A detailed medical and surgical history was taken. An X-ray of the affected knee was obtained for documentation. All patients were told to sign a copy of consent before surgery.

We studied age, gender, BMI, smoking, unilateral or bilateral knee replacement, ASA (only grade I and II). Exclusion criteria were: patients with ASA III and IV, revision surgery, osteomalacia, and bone metastasis.

We had the same team of surgeons to perform TKR surgery. We took patients' consent to publish all data. The duration of surgery was countered from the first minute of the incision till the closure of the wound.

Data will be analyzed using SPSS version 23. The P-value ≤0.05 was considered as significant.

Results

We had a total number of 68 patients who underwent surgery with full details. We had a female gender to be predominant in number 37 patients (54.4%), whereas the rest of the number of patients was 31 males (45.6%).

We found the younger patient was 44 years old, whereas the older patient was 75 years old. In order to organize the findings, we subdivided the patients to groups: Group 1 had the age from 44 years old to 54 years old, group 2 had the age of patients from 55 years old to 65 years old, and group 3 had the range of age from 66 years old to 75 years old.

We had 39 patients in group 1, 17 patients in group 2, and 12 patients in group 3 (Table 1).

	Frequency	Percentage
Gender		
Male	31	45.6 %
Female	37	54.4 %
Age		
44-54 years	39	57.3 %
55-65 years	17	25 %
66-75 years	12	17.6 %
Smoking		
Smokers	27	39.7 %
Non-smokers	41	60.3 %

Data analysis showed 41 patients were nonsmokers (60.3%), whereas 27 patients were smokers (39.7%). (Table 1).

Most of the population of our patients had grade II ASA (51 patients) in contrast to 17 patients in which they had grade I ASA. (Table 2)

In our study, 50 patients (73.5 %) had unilateral knee arthroplasty, and the rest (18 patients) had bilateral arthroplasty (Table 2).

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Table 2. Showing ASA grade & side of the injury.

	Frequency	Percentage
ASA grade		
Grade I	17	25 %
Grade II	51	75 %
Side of injury		
Unilateral	50	73.5 %
Bilateral	18	26.4 %

According to the BMI classification scale, out of 68 patients, there were 38 patients who were obese (55.9 %). On the other hand, 16 patients (23.5 %) were overweight, and 14 patients (20.6 %) were normal.

We found a strong relationship between obese patients and the duration of surgery. Out of 68 patients, 41 patients (60.2 %) needed 90 minutes to 120 minutes to complete the surgery (Table 3).

Table 3. The association of BMI classification & duration of surgery.

		Normal BMI	Overweight	Obese	Total	P value
Duration of Surgery	60 – 75 minutes	9	0	0	9	0.01
	75 - 90 minutes	0	18	0	18	
	90 - 120 minutes	0	0	41	41	
Total		9	18	41	68	

When the relationship between BMI and age, BMI and gender, BMI and side of surgery, BMI and ASA, and BMI and duration of surgery, we found a significant p value of 0.00, indicating a statistically significant relationship.

Discussion

For many years, BMI is considered as a primary factor for morbidity and mortality as a result of many diseases such as coronary artery disease, diabetes mellitus, and stroke. Studies found a strong relationship between the increase of the BMI and health risks.

Normal patients (BMI 15 kg/m^2 to 25 kg/m^2), overweight patients (BMI 25 kg/m^2 to 30 kg/m^2), obese patients (BMI 30 kg/m2 to 40 kg/m^2) and t morbidly obese (BMI > 40 kg/m^2) (5).

When we review the literature, we found most of the previous studies confirm the relationship between the increased BMI and degenerative knee changes.

There is an increasing in the number of patients who need knee arthroplasty. In addition, many researchers expect to increase the number greatly in the near future.

This is a result of increasing number of patient with obesity as it is directly related to total knee replacement.

In a previous study done by Kristen et al., he reported that risk of knee replacement surgery is increased by more than 40% in obese or overweight individuals (6).

Many studies showed a relationship between obese patients and the increased need for knee arthroplasty. Reviewing the literature, many studies suggested that obese patients who underwent total knee replacement needed more time to complete the surgery. In addition, bilateral total knee replacement needed a doubled time to perform surgery in comparison to single side surgery.

lozano et al. found no such differences in operative duration between normal and obese patients (7).

In contrast, our study showed a significant relationship between obesity and duration of surgery.

In a study by Valderrama et al. he concluded that early complications of total knee replacement and BMI are not related to each other (3).

Our study revealed that the female gender was the dominant more than males in number who underwent total knee replacement.

This study highlights the relationship between BMI and the duration of surgery for total knee replacement. Many and large studies are required to confirm this conclusion.

Surgeons may be reluctant to perform surgery for those with morbid obesity because of the duration of surgery and early complications.

Conclusions

To sum up, BMI or obesity plays a major role in the duration of surgery in patients who need total knee replacement. This time is doubled when the arthroplasty is bilateral.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of University of Aleppo, approval protocol number 216, 2023.

Informed Consent Statement: Written informed consent has been obtained from the patients to publish this paper.

Data Availability Statement: Data are available and it could be reached through the corresponding author.

Acknowledgments: None.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Lawrence, K.W., Sobba, W., Rajahraman, V. et al. Does body mass index influence improvement in patient reported outcomes following total knee arthroplasty? A retrospective analysis of 3918 cases. *Knee Surg & Relat Res* **35**, 21 (2023). https://doi.org/10.1186/s43019-023-00195-1)
2. RW Taylor, D Keil, EJ Gold, SM Williams, A Goulding, Body mass index, waist girth, and waist-to-hip ratio as indexes of total and regional adiposity in women: evaluation using receiver operating characteristic curves, The American Journal of Clinical Nutrition, Volume 67, Issue 1, 1998, Pages 44-49, ISSN 0002-9165, https://doi.org/10.1093/ajcn/67.1.44. https://www.sciencedirect.com/science/article/pii/S0002916523181603
3. A. Correa-Valderrama, W. Stangl-Herrera, A. Echeverry-V´elez, E. Cantor, T. Ron- Translateur, J.C. Palacio-Villegas, Relationship between body mass index and complications during the first 45 days after primary total hip and knee replacement: a single-center study from South America, Clin. Orthop. Surg. 11 (2) (2019 Jun 1) 159–163
4. Abbas Z, Hafeez S, Naseem A, Habib Y, Mumtaz H. Effect of body mass index on duration of total knee replacement surgery: A prospective cross sectional study. Ann Med Surg (Lond). 2022 Sep 23;82:104637. https://doi.org/10.1016/j.amsu.2022.104637. PMID: 36268351; PMCID: PMC9577639
5. Amin AK, Clayton RAE, Patton JT, Gaston M, Cook RE, Brenkel IJ. Total knee replacement in morbidly obese patients. J Bone Joint Surg Br. 2006;88-B(10):1321-1326. https://doi.org/10.1302/0301-620X.88B10.1769
6. K.M. Leyland, A. Judge, M.K. Javaid, A. Diez-Perez, A. Carr, C. Cooper, N.K. Arden, D. Prieto-Alhambra, Obesity and the relative risk of knee replacement surgery in patients with knee osteoarthritis: a prospective cohort study, Arthritis Rheumatol. 68 (4) (2016 Apr) 817–825
7. L.M. Lozano, M. Ti´o, J. Rios, G. Sanchez-Etayo, D. Popescu, S. Sastre, M. Basora, Severe and morbid obesity (BMI≥ 35 kg/m2) does not increase surgical time and length of hospital stay in total knee arthroplasty surgery, Knee Surg. Sports Traumatol. Arthrosc. 23 (6) (2015 Jun) 1713–1719